0258557

EX PARTE OR LATE FILED

DOCKET FILE COPY DUPLICATE

Sprint

1850 M. Street N.W., Suite 1100
Washington, DC 20036

June 1, 1998

RECEIVED

JUN - 1 1998

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Magalie Salas, Esq.
Secretary
Federal Communications Commission
1919 M Street N.W. Room 222
Washington, D.C. 20554

Re: Ex Parte Presentation -- CC Docket No. 97-211

Dear Ms. Salas:

On May 29, 1998, representatives from Sprint met with the Commission staff to discuss Sprint's position on issues raised in the above-referenced proceeding. Attending the meeting on behalf of Sprint were the undersigned; Leon M. Kestenbuam, Vice President, Federal Regulatory Affairs; David M. Eisenberg, Vice President - Law; Brad Hokamp, Director, Data Product Management, Business Services Group; and Stanley M. Besen, Vice President of Charles Rivers Associates, Inc. Attending the meeting on behalf of the Commission were A. Richard Metzger, Jr., Chief of the Common Carrier Bureau; Michelle Carey, Jennifer Fabian, Michael Kende, Michael Pryor, Eric Bash and Donald Stockdale all of whom are with the Policy and Program Planning Division of the Common Carrier Bureau; and Patrick DeGraba and Stagg Newman of the FCC's Office of Plans and Policy.

During the meeting, Sprint discussed its position in this proceeding as set forth in its Comments filed March 13, 1998 as well as its preliminary views -- based on press reports -- of MCI's announced sale of some of its Internet assets to Cable and Wireless. In addition, Sprint provided the Commission with a copy of a paper entitled "An Economic Analysis of the Impact of the WorldCom-MCI Merger on the Provision of Internet Backbone Services." The paper, a copy of which is enclosed, was prepared for Sprint by Charles Rivers Associates and presented to both the Department of Justice and the European Commission. Because

Sprint has furnished copies of the paper to the Commission staff and for the public record in this proceeding, it waives its claim to confidentiality as set forth on the top of each page of the paper.

If you have any questions or need more information, please contact me at 202-828-7438.

Respectfully submitted,

Michael B. Fingerhut
General Attorney

Enclosure

c: A. Richard Metzger, Jr. (w/o enc.)
Michelle Carey (w/o enc.)
Jennifer Fabian (w/o enc.)
Michael Kende (w/o enc.)
Michael Pryor (w/o enc.)
Eric Bash (w/o enc.)
Donald Stockdale (w/o enc.)
Patrick DeGraba (w/o enc.)
Stagg Newman (w/o enc.)

AN ECONOMIC ANALYSIS OF THE IMPACT OF THE WORLDCOM-MCI MERGER ON THE PROVISION OF INTERNET BACKBONE SERVICES

Stanley M. Besen
Padmanabhan Srinagesh
John R. Woodbury

Charles River Associates, Inc.
April 7, 1998

1. Introduction

The proposed merger of WorldCom and MCI will adversely affect competition in the core Internet backbone market. Core backbone providers sit at the top of the vertical structure of the Internet. They negotiate interconnection agreements with each other and with non-core backbone providers in which each backbone provider makes available an access service that offers information on routes to its customers, delivery to an interconnection point of packets sent by its customers to destinations served by the other backbone provider, and acceptance at an interconnection point of packets originated by the other backbone provider to destinations it serves. These agreements permit backbone providers to combine their networks to jointly produce seamless Internet connectivity using default-free routers and long-haul transport capability. Seamless Internet connectivity is an essential input used by all Internet Service Providers (ISPs) to provide a final good, Internet service, to their customers.

Core backbone providers currently interconnect on a settlement-free basis with each other and charge a fee for interconnection to non-core backbone providers. Accordingly, core backbone providers receive payments from other backbone providers for the services they offer. A hypothetical monopolist over core backbone services would be able to raise the price charged to non-core backbone providers because there are no close substitutes for the services it provides. As a result, the provision of core Internet backbone services is a relevant antitrust market. The proposed merger of WorldCom and MCI will lead to the creation of a dominant position which will adversely affect competition among core Internet backbone providers.

WorldCom-MCI would find it profitable to disadvantage remaining core backbone providers if it becomes dominant in the core Internet backbone market. This incentive exists because the costs to the customers of a dominant core backbone provider are less than the costs to the customers of a smaller core backbone if the quality of the interconnection between the backbones is degraded (for example, by failing to upgrade the number of interconnection points), or if the two core backbones are disconnected. WorldCom-MCI will also be able to raise the price it charges to non-core backbone providers for access.

The combination of WorldCom and MCI increases the amount of Internet traffic that is internal to its combined network, thus reducing the cost it incurs from reducing the quality of service to, or disconnecting from, a smaller backbone to a level below the costs incurred by WorldCom and MCI prior to the merger. By reducing the amount of external traffic, the merger increases the credibility of a

threat of service quality degradation or disconnection. The merger also increases the cost that a smaller backbone incurs from the threat of either a reduction in service quality, or disconnection, above the cost of similar behavior by either WorldCom or MCI prior to the merger. This increases the likelihood that a smaller backbone will accede to such a threat by paying for access to the WorldCom-MCI backbone.

The merger of WorldCom and MCI will also create entry barriers to potential core Internet backbone providers. An entrant into the core Internet backbone market must not only expend the resources needed to acquire or lease a nationwide transport system and acquire the associated default-free routers, but it must also gain access to the incumbent backbone providers. Without such agreements, an entrant's routers will be unable to compute a default-free routing table and forward packets to all Internet destinations and the entrant will be unable to supply seamless Internet connectivity to its customers.

Obtaining interconnection agreements is made more difficult if an existing core Internet backbone provider, such as the merged WorldCom-MCI, serves a very large portion of the core Internet backbone market. In particular, new entrants will face higher entry barriers after the merger because they will have to enter at a larger scale. A combined WorldCom-MCI, with a larger market share, might credibly threaten not to interconnect on a settlements-free basis with a smaller entrant because so much of WorldCom-MCI's traffic is internal to its own network. In order to equalize the bargaining power between the entrant and the merged firm, the entrant would have to acquire a large market share.

The potential entrant's ability to rapidly amass a large share is likely to be very limited at best. This is because the willingness of users to switch to the entrant depends on their belief that the entrant will be successful. The WorldCom-MCI merger makes entry more difficult because it reduces the probability that entry will be successful by increasing the credibility of the merged firm's threat to deny interconnection to the entrant or to degrade the quality of access service provided.

Thus, the potential entrant may be left with the choice of either paying a significant interconnection fee for access to WorldCom-MCI, or becoming a customer of an existing backbone provider. In either case, final consumers would be denied the benefits of entry into the core backbone market.

Barriers to entry may be created not only directly by the size of the combined WorldCom-MCI, but indirectly as well. If WorldCom-MCI degrades the quality of interconnection with incumbent core Internet backbone providers, or disconnects entirely from them, other ISPs and final consumers may be

induced to switch to the WorldCom-MCI network. This further increases the market share of the merged entity and, in turn, the required scale of entry.

In addition, after the merger, other core and non-core backbone providers may feel compelled to merge in order to attempt to offset the increased bargaining power of WorldCom-MCI. In this more concentrated market structure, a potential entrant may have difficulty reaching an interconnection agreement with any incumbent unless it can enter on a very large scale or pay significant interconnection fees for access to core backbone providers.

It is also important to observe that an entrant into the core Internet backbone market must incur significant costs, many of which will be unrecoverable if entry fails. If the merger increases the scale at which entry must occur, a firm is less likely to attempt to enter because the losses of failure are increased. By increasing the cost of failed entry, the WorldCom-MCI merger further raises the barriers to entry into the core Internet backbone market.

Note that the anticompetitive effects of the WorldCom-MCI merger result solely from the larger size of the merged firm and the nature of telecommunications networks. Here, these effects are not ancillary to any efficiencies attained by the merged firm. The effects follow simply because a network has grown larger as a result of the merger.

2. Industry Structure

The Internet is an unregulated, global, packet-switched network of computer networks held together by a mesh of interconnection arrangements among backbone providers. Routing of packets within the Internet is effected through the use of routing tables, which specify the address of the next router on the path to a destination address. A packet with a destination address that does not appear in the routing table of a router is usually forwarded to a default router. Default routing by all routers may produce routing anomalies, however. For example, a packet may become lost in a loop between two routers that "point" to each other as the default router. To avoid these anomalies, a coherent routing scheme for the Internet has been established through a set of core routers. These core routers do not forward packets with unknown addresses to default routers; they are default-free. Core routers drop packets with unknown addresses and return an error message to the source.

The set of full routes contained in the core router tables defines the reach of the Internet. Each device with an Internet Protocol (IP) address in the core router tables can communicate with all other devices with IP addresses in those tables. The acquisition of proper routes and the maintenance of accurate routing tables by the core routers are critical functions of routing protocols and router management.

Core routers are maintained by a number of backbone providers. By definition, every backbone provider has default-free routing capability. Each backbone provider obtains this capability by agreeing to exchange routing information with all other backbone providers in accordance with an industry standard known as Border Gateway Protocol, version 4 (BGP4). Each backbone provider also agrees to accept and deliver to its customers (end users and ISPs that purchase Internet connectivity from it) packets that are originated by another backbone provider. At the same time, each backbone provider agrees to deliver to another provider only those packets that are destined for final addresses on that provider's network. The exchange of routing information and packets is carried out at agreed upon interconnection points. We define access service to be the combination of the three elements of interconnection described above: exchange of routing information, packet origination, and packet termination at agreed upon interconnection points. When backbone providers interconnect, they purchase access from, and sell access to, each other.

The possession of routers capable of default-free routing and an owned or leased transport network are not, by themselves, sufficient to qualify an ISP as a backbone provider. Access to all other backbone providers is also necessary to produce seamless Internet connectivity for sale to downstream ISPs. Without such access, a backbone provider's router will not receive all the routing information required to compute a default-free, full routing table.

Backbone providers supply access to each other. Other (non-backbone) ISPs acquire Internet connectivity through one or more backbone providers and, in turn, offer service to other ISPs, or to final consumers. This vertical structure of the Internet is a consequence of its routing hierarchy, and relevant markets can be defined in terms of the functions described above.

The vertical Internet market structure is reflected in the range of interconnection agreements that link ISPs. These interconnection agreements vary in two important dimensions. The first concerns the nature of restrictions on the traffic exchanged by the interconnecting ISPs. In some arrangements, one ISP will agree to accept all traffic from another ISP to any address on the Internet and deliver traffic to that ISP from any Internet address. In other arrangements, an ISP will only accept traffic destined for

its (end user and ISP) customers and deliver traffic to the interconnecting ISP only from its customers. The second dimension involves settlements, or payments made by one ISP to another for interconnection. Combinations along these two dimensions can yield four different types of interconnection arrangements:

(i) **No restrictions on traffic exchange and a payment from one ISP to another.** In this case, one ISP pays another for transit. The seller of transit agrees to accept all traffic addressed to any valid Internet destination from the purchaser, and then forward it for ultimate delivery. The purchaser of transit can economize on its routing costs by pointing a default route to the supplier of transit. The supplier can recoup through transit charges the additional cost of producing seamless interconnectivity.

(ii) **Restrictions on traffic exchange and no payment from one ISP to the other.** Typically, these settlements-free, peering agreements are intended to allow each ISP to deliver traffic destined for customers (end users and ISPs) of the interconnecting network. Each ISP agrees that traffic destined for other (third party) ISPs will not be delivered to the peer ISP for transport to its ultimate destination. Thus, a peering agreement would be violated if either ISP pointed a default route at the other. Peering agreements of this type are typically negotiated by ISPs of roughly equal size that have a sufficiently high volume of inter-ISP traffic. Some large national backbone providers have settlements-free peering arrangements with one another. Some smaller regional ISPs with a sufficient volume of inter-ISP traffic also have settlements-free direct interconnection arrangements with one another, reducing their need to purchase transit services from ISPs with national backbones. These ISPs may point a default route to another ISP from which they purchase transit, but not to their peers.

(iii) **Restrictions on traffic exchange and a payment from one ISP to another.** This type of interconnection is of recent origin. Some ISPs that entered into settlements-free peering relationships with other similarly situated ISPs several years ago are now considerably smaller than their peers, and may pay for (restricted) connectivity to their erstwhile peers. The paying ISP may operate default-free routers, and may have its own backbone network, but it does not have a settlements-free peering relationship.

(iv) **No restrictions on traffic exchange and no payments made by either ISP to the other.** To the best of our knowledge, ISPs do not currently enter into interconnection agreements of this

type since both parties have an obvious incentive to abuse the agreement. The original interconnection arrangement at the Commercial Internet Exchange (CIX) was of this type.

All ISPs that maintain default-free routers, operate national backbones, and have negotiated access to all other such ISPs can offer seamless Internet connectivity, an essential input used by all ISPs. However, some backbone providers may have to pay other backbone providers for access. They compete in the provision of seamless Internet connectivity with core backbone providers, who receive these payments. The distinction between core and non-core backbone providers is important in defining the relevant market. In this market only core backbone providers are in a position to exercise market power and thus to achieve dominance in the market.

3. Market Definition

A hypothetical monopolist over core Internet backbone service would be able to raise prices to non-core backbone providers because there are no close substitutes for the services it provides.[1] According to the U.S. Department of Justice and Federal Trade Commission Horizontal Merger Guidelines, the ability of a hypothetical monopolist to raise prices establishes the existence of a relevant antitrust market:

> *"In determining whether a hypothetical monopolist would be in a position to exercise market power, it is necessary to evaluate the likely demand responses of consumers to a price increase. A price increase could be made unprofitable by consumers either switching to other products or switching to the same product produced by firms at other locations."*[2]

Similarly, the approach followed by the European Commission focuses on the availability of substitutes as a constraint on the ability of a firm or group of firms to raise prices:

---

1 Carlton and Sider note that: "Internet users demand, and Internet Service Providers (ISPs) make available, access to all sites on the Internet. In effect, this is the service that ISPs sell." See Second Declaration of Dennis W. Carlton and Hal S. Sider, attachment to Second Joint Reply of WorldCom, Inc. and MCI Communications Corporation, In the Matter of Applications of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications Corporation to WorldCom, Inc., Federal Communications Commission CC Docket No. 97-211, March 20, 1998 at para. 78. M.L. Katz and C. Shapiro, "Network Externalities, Competition, and Compatibility," 75 American Economic Review 424 (1985) at 424 note: "The central feature of the market that determines the scope of the relevant network is whether the products of different firms may be used together. For communications networks, the question is one of whether consumers using one firm's facilities can contact consumers who subscribe to the services of other firms. If two firms' systems are interlinked...then the aggregate number of subscribers to the two systems constitutes the appropriate network."

2 U.S. Department of Justice and the Federal Trade Commission Horizontal Merger Guidelines, Issued: April 2, 1992; Revised: April 8, 1997.

> *"A firm or a group of firms cannot have a significant impact on the prevailing condition of sale, such as prices, if its customers are in a position to switch easily to available substitute products or to suppliers located elsewhere. Basically, the exercise of market definition consists in identifying the effective alternative sources of supply for the customers of the undertakings involved, in terms both of products/services and of geographic location of suppliers."*[3]

A connection to any core backbone provider permits any Internet user to reach any other Internet user through the interconnection arrangements that exist among backbone providers. Although other routing arrangements may exist through which Internet users can interconnect with one another, these alternatives are vastly inferior.

Core backbone providers may compete with other ISPs to offer services to final consumers, but they compete only with each other and with other backbone providers to offer seamless Internet connectivity to non-backbone providers.[4] A hypothetical monopolist over core backbone services would be able to impose payments on, or raise prices to, other backbone providers. Other backbone providers would raise the prices they charge to ISPs that, in turn, would raise prices to final consumers. Because there are no close substitutes for the access services provided by core Internet backbone providers, the provision of core Internet backbone services is a relevant antitrust market.[5]

Only the output of core backbone services sold by core backbone providers should be included in computing market shares in the relevant market. This includes output sold to non-core backbone providers, output "sold" to other core backbone providers under settlement-free arrangements, and output consumed by the backbone itself. Output sold to downstream ISPs and final consumers should not be included because it does not represent sales to backbone providers.

---

3 Commission Notice on the definition of the market for the purposes of Community competition law (OJ [1997] C372/5) at para. 13. "Firms are subject to three main sources of competitive constraints: demand substitutability, supply substitutability and potential competition. From an economic point of view, for the definition of the relevant market, demand substitution constitutes the most immediate and effective disciplinary force on the suppliers of a given product, in particular in relation to their pricing decisions."

4 Internet backbone providers incur significant costs when they operate default-free routers and recover these costs through charges to non-core ISPs. However, competition among backbone providers limits these charges.

5 Alternatively, the market could have been defined as the provision of Internet backbone access, ignoring the distinction between those that make and receive payments. Such a market definition would not alter the conclusion that the WorldCom-MCI merger will significantly increase the ability of the merged firm to exercise market power because, as discussed below, backbone providers that make payments do not constrain the pricing behavior of those that receive payments.

Non-core backbone providers - those that make payments for access - cannot constrain the pricing of core backbone services. If a hypothetical monopolist raised the price of access to core backbone service, customers of the core backbones could not avoid the price increase by shifting to non-core backbones. This is because other backbone providers would also have to raise the prices they charge to other ISPs that, in turn, would raise prices to final consumers. Although shifting customers will still have complete Internet connectivity through the non-core backbones, their connectivity results from the non-core backbones having paid the higher price to the hypothetical monopolist. Because there are no close substitutes for the access services provided by core Internet backbone providers, the provision of core Internet backbone services is a relevant antitrust market and the output of non-core backbone providers and other ISPs should not be counted in computing market shares.[6]

4. Network Externalities and Bargaining Power

A critical factor in understanding the effect of the proposed WorldCom-MCI merger on the core Internet backbone market is the role played by network externalities in that market. Network externalities exist when "the utility that a user derives from consumption of [a] good increases with the number of other agents consuming the same good."[7] Direct network externalities exist when "one consumer's value for a good increases when another consumer has a compatible good, as in the case of telephones or personal computer software."[8] Network externalities are especially important for communications services like the Internet. As one author has noted: "The utility that a subscriber derives from a communications service increases as others join the system."[9]

Because the utility that one user of a communications network obtains depends upon the number of other users with whom he can communicate, the relationships among the firms that together provide the network are especially important. Of particular concern is whether these firms will behave co-

---

6 Similarly, only sales of core backbone services by core backbone providers should be included. While all customers of the hypothetical monopolist would be better off if they all (or a substantial portion of customers) formed their own network, the difficulties of co-ordinating such customer movement are likely to be substantial. This is identical to one of the difficulties a new core backbone provider would face if the merger were consummated, as described in the next section.

7 Katz and Shapiro, "Network Externalities, Competition, and Compatibility," at 424.

8 J. Farrell and G. Saloner, "Standardization, Compatibility, and Innovation," 16 RAND Journal of Economics 70 (1985) at 70. Farrell and Saloner (at 70-71) distinguish direct network externalities from those that exist "when a complementary good...becomes cheaper and more readily available the greater the extent of the (compatible) market."

9 J. Rohlfs, "A Theory of Interdependent Demand for a Communications Service," 5 Bell Journal of Economics and Management Science 16 (1974) at 16.

operatively in order to enhance the overall value of the services they collectively offer, or whether some firms will attempt to exploit the network externalities to their competitive advantage.

It has long been understood that a firm that serves a large proportion of a network may have incentives to make it more difficult for smaller suppliers to benefit from being part of the network. In particular, if the larger supplier can make its product incompatible with the products of its rivals, or disconnect its rivals directly, it may be able to increase its profits. This occurs because reducing the size of the network to which the rivals' customers are connected reduces the value of, and therefore the demand for, the rivals' products. This, in turn, reduces both the prices that the rivals can charge and the number of customers that they serve. In some circumstances, the market may "tip," with customers abandoning the rivals altogether because their networks are too small to be viable. In the context of the Internet, tipping would mean that a single backbone provider sold transit to all other ISPs.[10] Of course, if there is a single backbone provider, the distinction between core and non-core backbone providers is moot.

Katz and Shapiro explain why a firm with a large market share may oppose making its product compatible with that of a smaller rival. They note: "The problem is that the larger firm will lose market share to its smaller rival as a result of standardization. If it can unilaterally block standardization, it may do so, despite the fact that its rival and consumers would benefit."[11] The same authors observe that "[t]wo communications networks are incompatible if subscribers on one network cannot communicate with those on the other network."[12]

David and Greenstein also emphasize the critical role played by firms with large market shares.[13] They note (at 21): "Even a firm that holds a transiently large market acquires important leverage over the dynamics of a market-mediated standardization process....the nature of bandwagon effects that produce 'excess momentum,' as well as the strength of incentives to achieve coordination through negotiation, are sensitive to the relative shares of the market held by the competing firms."

---

10 Initially, customers may choose to interconnect with the dominant network while retaining their connection to their current supplier. However, given the high cost of Internet "multihoming," this arrangement is likely to be only temporary and customers may switch entirely to the dominant network. See Section 8 for a discussion of the costs of Internet multihoming.

11 Katz and Shapiro, "Network Externalities, Competition, and Compatibility," at 436.

12 M.L. Katz and C. Shapiro, "Systems Competition and Network Effects," 8 Journal of Economic Perspectives 93 (1994) at 105.

13 P.A. David and S. Greenstein, "The Economics of Compatibility Standards: An Introduction To Recent Research," 1 Economics of Innovation and New Technology 3 (1990).

Similarly, Farrell and Saloner note that one of their theoretical results "is consistent with frequent allegations that dominant firms intentionally make conversion costly in order to preserve their full network-size advantage over their smaller rivals." They go on to observe that "Frequently, these allegations are made with respect to the dominant firm's refusal to allow the smaller firm (or new entrant) to join the dominant firm's larger (or existing) network."[14]

In the present context, the concern is that WorldCom-MCI would find it profitable to disadvantage all other backbone providers if it becomes dominant in the core Internet backbone market. This incentive exists because the costs to the customers of a dominant core backbone provider are less than the costs to the customers of a smaller backbone provider if the quality of interconnection between the two backbones is degraded, or if the backbones are disconnected. In these circumstances, WorldCom-MCI will be able to impose charges on, or raise the price that it charges to, other backbone providers for access.

Consider two core backbone providers, one that has 90 percent and the other 10 percent of Internet customers. Assume, further, that the probability that a customer communicates with another customer does not depend on which core backbone serves them.[15] If the quality of interconnection between the two backbones were degraded, or if they were disconnected entirely, the cost to each customer of the larger backbone would be proportionally much smaller than the cost to each customer of the smaller backbone during the period of degraded quality or disconnected networks. Each customer of the larger backbone would have degraded quality on only 10 percent of its traffic while each customer of the smaller backbone would have degraded quality on 90 percent of its traffic. If there are diminishing returns, so that the value of high-quality connection to an additional customer declines as the number of customers reached increases, the total cost of degraded connection or disconnection incurred by customers of the smaller backbone will exceed the total cost incurred by customers of the larger backbone. During the period of degraded interconnection, customers of the smaller backbone will have an incentive to switch to the dominant backbone, which offers better quality. This incentive will be further increased if customers must incur recurring fixed costs to be connected to a backbone. In these

---

14 J. Farrell and G. Saloner, "Converters, Compatibility, and the Control of Interfaces," 40 Journal of Industrial Economics 9 (1992) at 31.

15 This assumption may be reasonable for networks that have historically been fully interconnected, as is true of the Internet and the Public Switched Telephone Network. Since all networks offer access to the same set of subscribers, customers choose a network provider on the basis of convenience, price, location, or other factors, and not on the basis of their calling patterns. Thus, there is no reason to expect traffic patterns across networks to be skewed in any particular direction.

circumstances, bargaining theory predicts that the larger backbone would have the power to obtain a larger share of the gains from high-quality interconnection.[16]

The merged WorldCom-MCI will enjoy an additional source of bargaining power, derived from the imperfect substitutability of the on-line information available through its separate backbones prior to the merger. If some of the information sources available on MCI are imperfect substitutes for information sources on WorldCom, the bargaining power each would have in negotiating separately with, say, Sprint is constrained by the availability of substitute information available through the alternative backbone. After the merger, however, WorldCom-MCI can make an "all or nothing" offer to Sprint for access to its combined backbones at a price that exceeds the combined prices that could be charged by WorldCom and MCI prior to the merger. The threat of a low-quality interconnection to the combined backbones of MCI and WorldCom is more significant to Sprint than similar threats from each of the separate backbones. The merger will therefore enhance the ability of WorldCom-MCI to raise the price of interconnection to other backbone providers.

For all the reasons described above, a larger core backbone operator has an incentive to threaten, at least implicitly, to degrade the quality of interconnection to, or to disconnect entirely from, its rivals in order to gain a competitive advantage.[17] If this dynamic process is widely understood by WorldCom-MCI and other backbone providers, the threat to degrade interconnection quality, or disconnect, need not be carried out. Instead, these other backbone providers may accede to WorldCom-MCI's demand for higher interconnection payments.

---

16 K. Binmore, A. Rubinstein and D. Wolinsky, "The Nash Bargaining Solution in Economic Modelling," 17 RAND Journal of Economics 176, Summer 1996. The percentages in the text are illustrative only. The magnitudes of the effects described will depend on the actual percentages of Internet customers served through each backbone. The larger the share of Internet customers served through the larger backbone and the larger the size disparity between the backbones the more likely is the outcome described.

17 WorldCom-MCI has pointed to the fact that the value of interconnection is the same to the customers of the two backbones, and has argued that this means the larger backbone has no incentive to disconnect. However, this ignores the fact that the value of interconnection is much less important to the customers of the larger backbone as a proportion of the value they derive from interconnection. If the disparity in backbone size is great enough, the customers of the larger backbone may scarcely notice that they have been disconnected while the customers of the smaller backbone may lose virtually the entire value of the service they had been receiving.

5. The Effect of the WorldCom-MCI Merger on the Core Backbone Market

A firm with a very large share of the core backbone market would be able to reduce the quality of interconnection to, or disconnect entirely from, other backbone providers. Although such a dominant firm might initially reduce the value of service to its own customers by taking such actions, it might also be able to use the actual or implicit threat of doing so to impose charges on smaller core backbone providers. In what follows, we focus on the implicit threat that the dominant firm will degrade the quality of interconnection in some way after the merger. In our view, such a threat would be more likely than a threat of complete disconnection. The economic analysis of the threat to disconnect parallels the analysis of the threat of degraded interconnection.

WorldCom-MCI can reduce the quality of service to all core backbone providers by failing to upgrade the number of points at which it interconnects with other providers, failing to upgrade the bandwidth of the interconnecting links, failing to promptly correct routing anomalies at interconnection points, or any combination of the above. The failure to increase the number of interconnection points can result in greater backhaul and latency for internetwork traffic, thereby reducing the quality of newer, time-sensitive multimedia applications (such as enhanced Web pages, video, and Internet telephony) that traverse the interconnection points. The failure to upgrade the bandwidth of the interconnecting links can lead to congestion and dropped packets at the interconnection points, introducing delay in the transfer of graphical Web pages, and degrading applications such as Internet telephony. Failure to correct routing anomalies might result in a loss of internetwork communication. In each case, a dominant provider with a relatively high proportion of internal traffic can offer its customers high quality on a greater fraction of their traffic than can a smaller provider with a correspondingly smaller proportion of internal traffic. It should be noted that, with the rapid growth of the Internet, the quality of interconnection can be significantly degraded by not upgrading existing arrangements as often as, or by as much as, growth warrants.

If implicit threats such as the possibility of reduced quality at interconnection points result in the imposition of charges by WorldCom-MCI to smaller core backbone providers for access to its network, the prices that these backbone providers charge to their ISP customers will also increase. This, in turn, will increase the prices charged by these customers to final consumers. This will also permit WorldCom-MCI to raise prices to its customers.

If WorldCom-MCI were actually to reduce the quality of its interconnection to a smaller core backbone provider, some of the customers of that provider would likely switch to another core provider, perhaps WorldCom-MCI, in order to maintain high quality on a higher proportion of their use. The likely growth of WorldCom-MCI serves to reduce the negative effect of reduced service quality on its customers and to increase the negative effect on the smaller core backbone provider. These effects are likely to be anticipated by WorldCom-MCI and non-dominant core backbone providers, and can increase the likelihood that the smaller provider will accede to a demand by WorldCom-MCI for payment for high-quality interconnection, obviating the need for the threat to be exercised. If the threat to reduce service quality is, in fact, exercised, prices for Internet access are likely to rise as a result of the increase in concentration in the core Internet backbone market.

After the merger, the combined entity will be able to reduce the quality of interconnection to smaller rival core Internet backbone providers for two complementary reasons. First, a combined WorldCom-MCI will increase the amount of Internet traffic that is internal to its combined network, thus reducing the cost it incurs from reducing the quality of service to a smaller rival below the cost incurred by WorldCom and MCI prior to the merger. By potentially reducing the value of external traffic to it, the combined entity increases the credibility of a threat to reduce service quality. Second, the merger increases the cost that a smaller rival incurs from a reduction of service quality above the cost of similar behavior by either WorldCom or MCI prior to the merger,[18] and thus increases the likelihood that a smaller rival would accede to such a threat by paying for continued high-quality interconnection to the WorldCom-MCI backbone.[19]

Prior to the proposed merger, WorldCom's share of the Internet backbone market, based on total bandwidth, was 23.00 percent and MCI's share was 23.88 percent, so that after the merger the combined share of the two companies will be 46.88 percent.[20] If we assume that the proportion of WorldCom-MCI Internet traffic exchanged with any other backbone provider is the same as the

---

18 This cost rises to the extent that traffic between the smaller core provider and WorldCom-MCI is large relative to the remaining traffic flows of the smaller core provider.

19 To the extent that addresses on the WorldCom-MCI network are unique (or uniquely valuable), the larger share of WorldCom-MCI will permit it to exercise the market power described in the text.

20 The source for these market shares is Internet Affidavit of Robert G. Harris On Behalf of GTE, submitted in Comments of GTE Service Corporation, Its Affiliated Telecommunications Companies, and GTE Internetworking, On WorldCom/MCI's Joint Reply to Petitions to Deny and Comments In the Matter of Applications of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications Corporation to WorldCom, Inc., Federal Communications Commission CC Docket No. 97-211, March 13, 1998. Harris cites http://www.boardwatch.com. We have included all backbone providers listed in Boardwatch in calculating market shares, although we believe that many do not meet our criteria for inclusion as core backbone providers. Our calculations thus understate WorldCom-MCI's market share in the relevant market.

proportion of total bandwidth held by that provider, the share of WorldCom-MCI traffic that will be exchanged "outside" its network is 53.12 percent.[21] This figure compares to 77.00 and 76.12 percent, respectively, for WorldCom and MCI prior to the merger. Thus, the merger reduces the dependence of the combined entity on connection to other backbone providers as compared to the dependence of each of the merging parties prior to the merger. This is the case because traffic that had formerly passed between the WorldCom and MCI backbones prior to the merger has moved "inside" the WorldCom-MCI network. Because of the reduced dependence of WorldCom-MCI on connection to other core backbones, the credibility of any actual or implied threat by WorldCom-MCI to reduce the quality of interconnection to any other core backbones is increased.[22]

In addition, these same statistics illustrate that the cost to other core backbone providers of degraded interconnection to WorldCom-MCI has increased as a result of the merger. This increases the likelihood that another core backbone provider will accede to such a threat by agreeing to pay for high-quality interconnection to the WorldCom-MCI backbone. Under our assumptions using these data, if, pre-merger, WorldCom-MCI were to degrade the quality of access to any other backbone provider, approximately 24 percent of the other backbone's traffic would be affected. Post-merger, that percentage nearly doubles. Thus, the cost to any other backbone provider of degraded interconnection to a WorldCom-MCI backbone is far greater than the cost of degraded interconnection to either the WorldCom or MCI backbone.[23] This, too, increases the likelihood that other backbone providers such as Sprint would accede to an implicit threat to have the quality of interconnection degraded and would pay for high-quality interconnection to the backbone of the combined entity.

It should also be noted here that the ability of any backbone provider to resist a threat to have the quality of its interconnection degraded is increased the greater is the share of the market held by that provider. As we have previously noted, this is because a provider with a larger market share has less to lose from quality degradation or disconnection than one with a small share. Thus, a backbone provider

---

21 Thus, if another core Internet provider accounts for 10 percent of total bandwidth, we assume that it also accounts for 10 percent of WorldCom-MCI's traffic. Similarly, if, say, WorldCom-MCI were to account for 50 percent of total Internet bandwidth, we assume that it accounts for 50 percent of the traffic of every core backbone provider, including itself. Although bandwidth, or traffic, measures market share somewhat imperfectly, we are restricted to using publicly available information in performing these calculations.

22 The analysis of degraded interconnection applies, mutatis mutandis, to the threat by WorldCom-MCI to disconnect from other core backbone providers.

23 As we discuss in the next section, this affects not only the other current core backbone providers but also any potential entrant.

with a small market share is more vulnerable than is one with a large share. This has two important implications.

First, the likelihood that a combined WorldCom-MCI will be able to implement a strategy of threatening degraded interconnection in order to impose charges for interconnection is greater the less concentrated are the remaining core backbone providers. Thus, what is important in judging how effective the strategy will be is not only the combined share of the market held by other core backbone providers but also the extent to which that share is fragmented among different providers. This implies that traditional measures of industry concentration such as the Herfindahl-Hirschman Index (HHI) may not be useful in determining whether WorldCom-MCI will be able to dominate the core Internet backbone market after the proposed merger. This is because WorldCom-MCI will be less successful in threatening degraded interconnection the more concentrated are the remaining core backbone providers.[24]

Second, the proposed merger could induce the remaining core backbone providers to combine in order to acquire countervailing market power against WorldCom-MCI. The analysis presented here indicates that the credibility of a threat to degrade interconnection is smaller the larger is the threatened core backbone provider, so that WorldCom-MCI will be less likely to threaten to degrade interconnection to a newly-merged entity than to threaten each of the merger partners separately. Similarly, the cost of degraded interconnection is smaller for a merged entity, so that it would be better able to resist a threat than would any of its members prior to the merger. Indeed, Carlton and Sider contend that if WorldCom-MCI were to pursue a strategy of discriminating against some rival backbone providers, this would cause a "realignment" that "could enable networks other than MCI WorldCom to take advantage of economies of scale in purchasing access from MCI WorldCom...".[25]

Although this would reduce the threat that WorldCom-MCI could disadvantage its core backbone rivals, it does not mean that the WorldCom-MCI merger, and any "realignment" undertaken in response, is benign. Suppose, for example, that the WorldCom-MCI merger were to encourage the remaining backbone providers to combine in order to be able to bargain for access on equal terms with WorldCom-MCI. Although this might result in a settlement-free access arrangement between the two

---

24 The HHI may be useful, however, in judging how likely it is that the core backbone providers will be able to raise prices to other ISPs, either through unilateral behavior or tacit coordination.

25 Carlton and Sider, at para. 86.

dominant core backbone providers, other (non-backbone) ISPs might still face higher prices. This is because the reduction in the number of backbone providers reduces the competitive alternatives available to these ISPs. This increases the potential for the exercise of market power against non-backbone ISPs and, ultimately, final consumers.

6. Alternative Measures of Market Shares

In our calculations of market shares in the core backbone market, we employed data on the bandwidth of backbone providers as calculated by Harris based on data reported in Boardwatch. Although this measure is imperfect in a number of ways, we believe that it has advantages over other share measures that have been proposed. This section presents our analysis of a number of alternative measures of market shares in the core backbone market.

6.1 Market Shares Based on Number of Consumers Served

One possible measure of market share is the number of final consumers served through a core backbone provider. There are at least two possible difficulties with such a measure, however. First, the measure should take into account all consumers served by all ISPs that obtain Internet connectivity through that backbone, but that information is likely to be difficult to obtain. Second, all consumers do not generate the same amount and value of Internet traffic and it is likely to be difficult to account for such differences. For both these reasons, the number of consumers is likely to be a highly imperfect measure of market share.

6.2 Market Shares Based on Revenues

Another possible measure of the market share of a core backbone provider is the revenue it receives. There are four possible problems with this measure, however. First, the reported revenues of a core backbone provider may include not only revenues from the sale of core backbone services but also revenues from sales of transit services to non-backbone ISPs, and sales to final consumers. Only revenues from the provision of core backbone services should be included in computing market shares.[26]

---

26 MCI/WorldCom have recently claimed that they only have about 20% market share of the "Internet Service Provider market place". However, this estimate is misleading because it is based on total industry revenues of consumer, business, and wholesale Internet services in the US in 1997, not on revenues in the core Internet backbone market.

Second, core backbone providers are involved in settlement-free transactions with other core backbone providers. In these transactions, core providers make available valuable services to each other through a form of barter. The imputed value of these bartered services should be included in computing market shares based on revenues. Since the arrangements among large core backbone providers are likely to involve the exchange of services that have high value, revenue estimates that do not account for them may be subject to considerable error.

Third, payments from non-core backbone providers to backbone providers do not take into account the value of the access services provided by the non-core providers. The value of these access services must also be imputed in determining the value of the services provided by the core providers.

Finally, a significant amount of the core backbone services that are provided by a large core backbone provider are used by the provider itself. Indeed, one of the significant aspects of the WorldCom-MCI merger is that it would eliminate the settlement-free transactions that now occur between WorldCom and MCI. If the transactions that are brought inside WorldCom-MCI by the merger were ignored, it would be concluded (erroneously) that the merger has reduced the combined market shares of the merging parties.

Eliminating revenues from the sale of services other than core backbone services from a core backbone provider's revenue may be feasible. However, imputing the value of the services that are "sold" on a settlement-free basis with other core providers or in transactions with non-core backbone providers, or that are used internally by a core backbone provider, is likely to be a formidable, if not impossible, task. For this reason, market shares based on revenues are not likely to be especially useful.

6.3 Market Shares Based on Backbone Traffic

Another possible measure of the market share of a core backbone provider is the amount of traffic it carries. However, reported traffic may a poor measure of the market share of a backbone. Every backbone consists of multiple nodes and traffic may enter the backbone at one node and exit at another. A backbone provider with many nodes may generate a small amount of "backbone" traffic when compared to one with few nodes simply as an artefact of the network architecture it employs. This is because a node may directly route traffic to all end users reached through that node and send to the backbone only traffic intended for destinations reached through other nodes and may count only the

latter as "backbone" traffic. For these reasons, the measured amount of backbone traffic for any provider may present a misleading measure of its market share.

Perhaps more important, traffic may flow through more than one backbone from source to destination. Estimating the total amount of Internet traffic by summing the amounts served by each backbone thus involves some double counting. Because the amount of double counting will differ among backbones, market shares based on traffic estimates can be highly misleading.

An implication of this analysis is that the total amount of backbone traffic carried over the combined WorldCom-MCI backbone will appear to be less than the total amount of traffic carried over the pre-merged WorldCom and MCI backbones, because all traffic that transited both backbones was counted twice before the merger, but will only count once after the merger. Given the (artificial) reduction in total traffic after the merger, the traffic shares of other backbone providers will necessarily rise. This perverse result occurs because backbone traffic is a poor measure of market share.

6.4 Market Shares Based on Number of POPs

Market shares based on the number of Points of Presence (POP) of a core backbone provider may have some merit, but they are also subject to important limitations. Conceptually, the reason for using POPs to measure market share lies in the high correlation that might be expected between the number of final customers that a backbone serves and the number of POPs it has deployed. Typically, a backbone provider will deploy a POP once it has a critical mass of customers it can serve from that POP, permitting it to spread the costs of the POP over a sufficiently large number of end users. By this logic, the total number of POPs belonging to a core backbone provider and to all the ISPs that obtain connectivity through that backbone provider might be a useful measure of market share in the core backbone market. However, the POPs of the core backbone provider itself are likely to be poor measure of its market share in the relevant market.

Moreover, different backbone providers may have chosen different network architectures, leading to a different number of POPs that serve essentially identical customer populations. In particular, providers link their backbones to their customer locations with private lines have an incentive to locate POPs close to their customers, since private lines have distance sensitive-tariffs, while those that use Frame Relay links to their customers may use fewer POPs since Frame Relay prices are not distance sensitive.

While a core backbone provider with more POPs is likely to have a larger number of end users, the correlation may be highly imperfect.

6.5 Market Shares Based on Backbone Capacity

Our measure of market share is based on a sample of 1,675 ISPs on which Boardwatch maintains information. Based on this sample, Harris weighted each ISP's connection to a backbone by the bandwidth of that connection, and obtained the total bandwidth (or capacity) linking each backbone to end users. Since capacity is typically installed in increments when links are congested, the capacity measure is likely to correlate, albeit imperfectly, with usage, and, hence, with the number and type of customers served directly or indirectly through that backbone.

7. Barriers to Entry

The merger of WorldCom and MCI would create entry barriers to potential core Internet backbone providers.[27] Such an entrant must expend the resources needed to acquire both access to a nationwide transport system and the associated default-free routers. In addition, an entrant must obtain agreements for the exchange of traffic with all incumbent Internet backbone providers. Without such an agreement, the entrant's routers will be unable to compute a default-free routing table and forward packets to all Internet destinations. An entrant must serve a significant number of unique Internet addresses in order to encourage existing core Internet backbone providers to reach interconnection agreements with it.

Obtaining interconnection agreements is made more difficult if an existing core Internet backbone provider, such as the merged WorldCom-MCI, carries a very large portion of Internet traffic. Just as the merger would disadvantage existing core Internet backbone providers in bargaining with the merged entity, the merger would disadvantage potential entrants when they first attempted to negotiate interconnection agreements with WorldCom-MCI.[28] The combined entity may threaten to degrade the quality of interconnection to existing backbone providers, or disconnect them entirely, in order to impose charges for interconnection. For the same reasons, a combined WorldCom-MCI may be able to

---

27 We do not consider the question of whether there may currently be barriers to entry into the core Internet backbone market but instead focus on the extent to which the WorldCom-MCI merger would create such barriers. Thus, for example, we do not examine the question of Internet address portability, which has been raised by others.

28 Of course, the merger would also disadvantage non-core backbone providers that seek to become core backbone providers.

provide low-quality interconnection to, or refuse to interconnect with, new entrants, in order to impose significant charges for interconnection.

Potential entrants will face higher entry barriers after the merger because they will have to enter at a larger scale. If the core Internet backbone market is served by a number of firms no one of which has a very large market share, an entrant must provide service to enough unique Internet addresses for each of the incumbent firms to find it attractive to reach interconnection agreements with it. In such cases, each of the incumbents would suffer a significant loss if its customers could not reach the customers of an entrant that serves a significant number of unique addresses, and a threat by any incumbent not to connect with such an entrant would not be credible. Thus, both WorldCom and MCI, as well as other incumbent core backbone providers, might be willing to interconnect on a settlements-free basis with an entrant that is of the same general size as current core backbone providers.

By contrast, a combined WorldCom-MCI, with a larger market share, might credibly threaten not to interconnect on a settlement-free basis with the same entrant, because so much of WorldCom-MCI's traffic is internal to its own network.[29] This would leave the entrant with the choice either of paying a significant interconnection fee to WorldCom-MCI, or purchasing transit by becoming a customer of an existing backbone provider. Interconnecting with all other core backbone providers does not permit entry as a core backbone provider if the entrant cannot also interconnect with the dominant backbone provider and exchange traffic with it. Peering agreements with other core backbone providers do not include transit to the dominant core provider that refuses to interconnect.

It is important to emphasize here that barriers to entry exist even if entrants such as Qwest and AT&T have "available technology and equipment from third-party suppliers and through leased transmission capacity from a variety of network suppliers."[30] The reason is that access to technology and equipment are necessary but not sufficient for entry. Entrants into the core backbone market also require interconnection agreements with other core backbone providers, and the WorldCom-MCI merger will make obtaining those agreements more costly.

---

29 In "Network Externalities, Competition, and Compatibility," Katz and Shapiro note (at 425) that "firms...with large existing networks will tend to be against compatibility, even when welfare is increased by the move to compatibility."

30 Carlton and Sider, at para. 78.

Barriers to entry may be created not only directly by the size of the combined WorldCom-MCI, but indirectly as well. If WorldCom-MCI disconnects incumbent core backbone providers, raises interconnection fees to them, or degrades the quality of interconnection, other ISPs and final consumers may be induced to switch to the WorldCom-MCI network. This further increases the market share of the merged entity and, in turn, the required scale of entry. In addition, after the merger, other backbone providers may merge in order to attempt to offset the increased bargaining power of WorldCom-MCI. In those circumstances, an entrant may have difficulty reaching an interconnection agreement with any incumbent unless it can enter on a very large scale or pay significant interconnection fees.[31]

A potential core backbone entrant must attract a sufficient number of unique Internet addresses to be able to bargain effectively with incumbent core backbone providers for settlement-free interconnection. If the required scale of entry is small, the firm may be able to enter initially as a non-core backbone provider that purchases access, or even as an ISP that provides service to end users, approaching incumbents for settlement-free interconnection only after it has grown significantly. The merger of WorldCom and MCI increases the number of users that a potential entrant must attract before it can credibly negotiate with the incumbents, making this type of entry more difficult.[32]

Finally, it is important to observe that an entrant into the core Internet backbone market must incur significant costs, many of which will be unrecoverable if entry fails. As we have already noted, the WorldCom-MCI merger increases the necessary scale of entry, and thus the level of sunk costs that an entrant must incur. If entry can occur at a relatively small scale, an entrant might be willing to risk incurring sunk costs in an attempt to become a core backbone provider, because the losses, if it is unsuccessful, are relatively small. If, however, the merger increases the scale at which entry must occur, a firm is less likely to attempt to enter because the losses from failure are increased. By increasing the cost of failed entry, the WorldCom-MCI merger further raises the barriers to entry into the core Internet backbone market.[33]

---

31 The increased level of concentration, created both directly by the WorldCom-MCI merger and indirectly by subsequent defensive mergers, would be likely to raise the price of interconnection to other ISPs even if it did not raise entry barriers.

32 "Systems Competition and Network Effects," Katz and Shapiro, note (at 111) that "[a]symmetries involving reputation, product differentiation, and installed base are especially likely when one of the firms is an entrant and the other is an incumbent. Under incompatibility, the entrant will suffer an installed base disadvantage and may well suffer a reputational disadvantage as well." Failure to interconnect with the entrant is the economic equivalent of rendering the entrant's network incompatible.

33 Katz and Shapiro, "Systems Competition and Network Effects," note (at 111) that "Incompatibility...discourages entry by requiring that entry must happen at a minimum size to be viable, which involves putting a sunk investment at risk."

8. Other Potential Sources of Competitive Discipline

In this section, we examine two mechanisms that could potentially limit the market power of WorldCom-MCI and show that neither mechanism is likely to be effective in doing so. The first mechanism we consider is the countervailing power of large downstream ISPs, such as America Online (AOL). The second is the ability of customers to "multihome," reducing their dependence on connectivity to WorldCom-MCI.

8.1 The Effects of Large Buyers Such as AOL

Our analysis indicates that the merger may leave WorldCom-MCI with sufficient power to raise the prices paid for access by other backbone providers. WorldCom-MCI's ability to raise these prices results from the fact that a higher proportion of its traffic will be internal to the combined WorldCom-MCI network, insulating it to a greater degree than any other network from the effects of degraded interconnection on the service quality to its customers.

If a large number of WorldCom-MCI customers could easily move to other backbone providers, WorldCom-MCI would not find it profitable to engage in such behavior. The co-ordinated movement of a large number of individual end users is likely to be costly, however. A more likely scenario is that a large downstream ISP, such as AOL, would switch all of its end users from WorldCom-MCI to another backbone provider. This would reduce the proportion of WorldCom-MCI's traffic that is internal to its own backbone, increase its dependence on interconnecting to other backbones, and reduce its market power. Nonetheless, the potential movement of large customers like AOL from WorldCom-MCI may fail to provide competitive discipline.

Although AOL can move all of its (approximately 12 million) customers from one core backbone provider to another (with such a shift limiting the ability of any provider to exercise market power), a large provider such as WorldCom-MCI could offer AOL lower rates than those charged to other ISPs in order to discourage AOL's defection to another backbone. Since WorldCom-MCI has raised its rivals' costs by charging for interconnection, its rivals may not be able to match these rates.

The lower rates charged by WorldCom-MCI to AOL could take the form of discriminatory term and volume discounts, which would provide AOL an incentive to obtain all its core connectivity through WorldCom-MCI. If AOL's rivals in the downstream market were not offered the same terms, AOL

would obtain a competitive advantage in the downstream market through its favored relationship with WorldCom-MCI. Since the combined entity will have considerable freedom to set prices in an unregulated Internet, it will have an incentive and the ability to offer discounts that advantage AOL, and hence, itself. AOL will, in turn, have an incentive to accept these lower rates. In effect, by sharing a portion of its increased profits with AOL, and other large downstream ISPs, WorldCom-MCI may discourage their defection and thus may be able to continue to exploit other users.

AOL has already signed a five year contract under which WorldCom will become its largest network service provider.[34] Alliances between WorldCom-MCI and large downstream ISPs may serve to skew the incentives of these ISPs and render them ineffective in disciplining the market for backbone services.

8.2 Multihoming

In its ex parte presentation to the FCC on March 12, 1998, WorldCom argued that "Multihoming is Easy." An implication of this claim, if true, is that WorldCom-MCI customers can "easily", i.e., at low cost, connect to multiple backbone providers ("mulithoming"). If a substantial number of WorldCom-MCI customers were to avail themselves of the multihoming option, the number of Internet addresses available only through WorldCom-MCI would be relatively low, rendering harmless any threats by WorldCom-MCI to degrade the quality of its interconnection to, or to disconnect entirely from, other backbone providers.

This argument is most easily seen in the extreme case where every ISP is multihomed on every backbone provider. In this case, no backbone needs to be interconnected to any other backbone, and no backbone can behave anticompetitively by refusing to peer or otherwise interconnect with another backbone.

There is considerable evidence that multihoming is neither easy nor inexpensive. An end user, or ISP, with a single connection to an upstream provider can use a low-end router (such as a Cisco 2501), configure it with the Point to Point protocol (PPP), and point a default route to the upstream provider. PPP is a passive routing protocol, and is relatively easy to manage.

---

34 http://www.perscberichten.com/pb2/overig/080997/worldcom.com

By contrast, an end user or ISP that multihomes must maintain separate connections to each upstream provider. The efficient management of these connections requires the use of more advanced routing protocols; typically, Border Gateway Protocol, version 4 (BGP4) is used. This protocol is complex to manage, and it imposes higher costs than PPP on both the customer and the upstream provider. The additional costs of running BGP4 vary with the specifics of a given situation. However, UUNET/WorldCom has asserted that these added costs are significant:

> *"Thus, we require all of our multiply-homed resale customers to maintain active BGP4 routing with UUNET. This includes customers who are singly-homed to UUNET, but who may have multiply-homed customers connected to them."*
>
> *"Our regular service pricing is based on certain estimates of actual customer line use and on estimates of the amount of time we will need to spend to support our customers. Because our wholesale customers have other customers connected behind them, their aggregate use of our backbone tends to be higher than what we see from our regular customers. **Also, the amount of work that we need to put into managing and configuring the routing for our wholesale customers is much more substantial than what we need to do for our customers.** Because wholesale customers use more of our backbone facilities and because they also place greater demands on our staff, we charge more for our wholesale services."*[35]

These two statements, taken together, amount to the assertion that multihomed customers are more expensive to deal with, and that the additional costs of dealing with them are passed on to these customers. According to UUNET/WorldCom, therefore, multihoming is not easy.

This conclusion is supported by others with routing expertise. One source begins a discussion of BGP4 and multihoming with a warning: "This is dangerous stuff. It's always best if you can test BGP configurations in a "lab" made up of a few Cisco 2501s before implementing them in a live network connected to the Internet. Unfortunately, there's no good reference on 'using BGP' to refer people to."[36]

---

35 Taken from "UUNET Wholesale Service Description" at the UUNET Web site, http://www.usa.uu.net, downloaded on 3.26.98; emphasis added.

36 Avi Freedman, "BGP Routing Part I: BGP and Multihoming" downloaded from (http://ww.netaxs.com/~freedman/bgp.html on 3.19.98.

Multihoming is not, in fact, a common practice among ISPs. According to the June 1997 issue of Boardwatch magazine, a survey of 4,455 ISPs shows that there are, on average, 1.1565 connections to backbones per ISP. If we assume that no ISP purchases connectivity from more than two backbones, only 15.6 percent of downstream ISPs are multihomed. Since the data show some ISPs buying connectivity from three backbones, the extent of multihoming is even smaller. However, the proportion of multihomed sites is so small that the total Internet "value" accounted for by these sites is likely to be small as well.

There is another reason why the Boardwatch data may overstate the extent of multihoming. ISPs that serve customers in multiple cities have available several architectural alternatives for obtaining Internet connectivity for their customers. One is to deploy a (possibly leased) backbone interconnecting the nodes they have in all the cities they serve. The ISP could aggregate all its external traffic and deliver it to a single backbone provider from which it purchased transit. In this case, the ISP would be single-homed. In an alternative architecture, the ISP would not deploy its own backbone. Instead, it would purchase transit separately in each city that it serves, perhaps dealing with a different provider in each city. This might occur when ISPs in different cities merge with each other or are acquired by other ISPs. In such cases, each final customer will be reachable only through a single core backbone provider, but the ISP will appear in Boardwatch's database as a purchaser of multiple connections. This provides an additional reason why the Boardwatch numbers are likely to overestimate the extent of multihoming.

The low incidence of multihoming may arise for reasons other than the complexity and the costs outlined above. Smaller ISPs whose traffic justifies a single T1 (1.5 Mbps) connection to a backbone may not be able to afford the added expense of two fractional T1s to two ISPs. In addition, backbone providers offer a form of quantity discount: T1 connectivity is often 4 to 6 times as expensive as DS0 (64 Kbs) connectivity, even though the former connection has 24 times the capacity. Multihomed customers are not able to take advantage of the implicit volume discount.

Given the relatively high cost and low incidence of multihoming, the threat by the combined WorldCom-MCI to degrade its interconnection to, or to disconnect entirely from, another backbone is likely to be viewed as a credible threat. Thus, the technical feasibility of multihoming cannot be viewed as ensuring that the merged entity will lack market power. Moreover, even if multihoming were to limit WorldCom-MCI's market power, the costs would be substantial.

9. Conclusions

The proposed merger of WorldCom and MCI will adversely affect competition in the core Internet backbone market. Backbone providers negotiate interconnection agreements for access to each other's networks, where "access" consists of information on the routes reached through the backbone, and packet origination and termination services. Each backbone provider supplies access to its network and demands access to the networks of interconnecting backbone providers. Core backbone providers currently interconnect on a settlements-free basis with each other and charge a fee for interconnection to non-core backbone providers.

After the merger, WorldCom-MCI will have a greater proportion of internal traffic on its combined network than the separate WorldCom and MCI networks. As a result, the combined network will experience lower costs than the separate networks from degraded interconnection to, or disconnection from, other core backbone providers. WorldCom-MCI will, thus, have greater bargaining power in interconnection negotiations with other core backbone providers, and will be able to increase its competitors' costs by charging for interconnection. Other core backbone providers will pass on these increased interconnection costs to their customers, and prices to end users will rise, as a consequence. WorldCom-MCI's increased bargaining power could also be used to raise new barriers to entry. The combined entity could refuse to interconnect with, or could provide low-quality interconnection to, a potential core backbone entrant unless the entrant acceded to its demand for higher interconnection charges. Higher interconnection charges would raise the cost of entry. In addition, the scale of entry to the core backbone market would rise, since entering backbone providers would be at a bargaining disadvantage as long as they were considerably smaller than the merged WorldCom-MCI backbone. While the bargaining asymmetries between WorldCom-MCI and other backbone providers are difficult to quantify on the basis of publicly available information, the Commission may have, or may be able to request, specific information from WorldCom and MCI on the interconnection agreements currently in effect between their backbones and others. This information, together with the experiences of other backbone providers that were unable to obtain, or recently lost, their settlements-free peering relationships with either MCI or WorldCom, may enable the Commission to judge the likelihood that the merged entity will have the incentive and ability to raise prices in the manner indicated by our analysis.